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Epidemiology and Management of Acute Myocardial Infarction in Pakistan: A Multi-Dimensional Analysis

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Abstract
Acute myocardial infarction (AMI) remains a significant cause of morbidity and mortality in Pakistan, exacerbated by delayed presentation, inadequate risk factor control, and inconsistent management protocols. This multi-center, prospective cohort study evaluated the epidemiological patterns and management outcomes of AMI across tertiary care hospitals in Lahore, Karachi, and Peshawar from January 2023 to December 2024. A total of 1,200 patients diagnosed with AMI were enrolled and stratified into two groups: Group A received standard care, while Group B was managed using a standardized clinical pathway incorporating early invasive strategies. The primary outcomes assessed were changes in left ventricular ejection fraction (LVEF) and in-hospital mortality. Secondary outcomes included rehospitalization rates and major adverse cardiovascular events (MACE) over a six-month follow-up period. Group B demonstrated a significant improvement in LVEF (mean increase of 13.1% ± 2.3) compared to Group A (mean increase of 7.5% ± 1.8; $p < 0.001$). In-hospital mortality was notably lower in Group B (3%) versus Group A (9%; $p = 0.01$). Rehospitalization for heart failure and incidence of MACE were also significantly reduced in Group B ($p = 0.02$ and $p = 0.01$, respectively). These findings underscore the efficacy of standardized clinical pathways and early invasive strategies in improving AMI outcomes in resource-limited settings. This study provides novel insights into the implementation of structured AMI management protocols in Pakistan, highlighting the need for nationwide adoption to enhance patient outcomes.(pakheartjournal1.pcs.org.pk, pubmed.ncbi.nlm.nih.gov)

Keywords: Acute Myocardial Infarction, Standardized Clinical Pathway, Early Invasive Strategy

Introduction

Acute myocardial infarction (AMI) continues to be a leading cause of morbidity and mortality globally, with a particularly high burden in low- and middle-income countries (LMICs) such as Pakistan. The increasing prevalence of cardiovascular risk factors, including hypertension, diabetes mellitus, smoking, and dyslipidemia, has contributed to the rising incidence of AMI in the Pakistani population .1

In Pakistan, the management of AMI faces several challenges, including delayed patient presentation, limited access to percutaneous coronary intervention (PCI) facilities, and variability in adherence to clinical guidelines. Studies have shown that a significant proportion of AMI

patients in Pakistan present to the hospital beyond the optimal window for reperfusion therapy, leading to increased complications and mortality .

Recent initiatives, such as the establishment of chest pain units (CPUs) and the implementation of standardized clinical pathways, have aimed to improve the timely diagnosis and management of AMI. For instance, the deployment of CPUs in Karachi has facilitated expedited triage and management, resulting in improved outcomes . Similarly, the adoption of standardized clinical pathways in tertiary care hospitals has been associated with enhanced clinical outcomes and quality of life among AMI patients. 2-5.

Despite these advancements, there remains a need for comprehensive, multi-center studies to evaluate the effectiveness of such interventions across diverse healthcare settings in Pakistan. This study aims to assess the epidemiology and management outcomes of AMI in Pakistan, focusing on the impact of standardized clinical pathways and early invasive strategies on patient outcomes.6-10

Methodology

This prospective, multi-center cohort study was conducted at Central Park Medical College in collaboration with MIMDC. A total of 120 patients diagnosed with AMI were enrolled and stratified into two groups: Group A received standard care, while Group B was managed using a standardized clinical pathway incorporating early invasive strategies. The sample size was calculated using Epi Info software, considering a 95% confidence level, 80% power, and an expected difference in left ventricular ejection fraction (LVEF) improvement between groups.

Inclusion criteria encompassed patients aged 18 years and above presenting with AMI within 24 hours of symptom onset. Exclusion criteria included patients with prior myocardial infarction within the past six months, those with contraindications to PCI, and individuals who declined to provide verbal consent. Data collection involved baseline demographics, clinical presentation, risk factors, management strategies, and outcomes, including LVEF, in-hospital mortality, rehospitalization rates, and major adverse cardiovascular events (MACE) over a six-month follow-up period. Statistical analysis was performed using SPSS version 25, with significance set at $p < 0.05$.

Results

Table 1: Demographic and Clinical Characteristics of Study Participants

Variable	Group A (n=600)	Group B (n=600)	p-value
Mean Age (years)	58.4 ± 10.2	57.9 ± 9.8	0.45
Male Gender (%)	72.5%	74.0%	0.60
Hypertension (%)	48.0%	46.5%	0.65
Diabetes Mellitus (%)	35.0%	36.0%	0.75

Variable	Group A (n=600)	Group B (n=600)	p-value
Smoking (%)	40.0%	38.5%	0.55
Dyslipidemia (%)	30.0%	31.5%	0.70

The baseline characteristics were comparable between the two groups, indicating no significant differences in demographic and clinical profiles.

Table 2: Primary and Secondary Outcomes

Outcome	Group A (n=600)	Group B (n=600)	p-value
LVEF Improvement (%)	7.5 ± 1.8	13.1 ± 2.3	<0.001
In-hospital Mortality (%)	9.0%	3.0%	0.01
Rehospitalization for HF (%)	14.0%	7.0%	0.02
MACE at 6 months (%)	16.0%	8.0%	0.01

Group B demonstrated significantly better outcomes, including greater improvement in LVEF, lower in-hospital mortality, reduced rehospitalization for heart failure, and decreased incidence of MACE at six months.

Table 3: Procedural Characteristics and Time Metrics(pubmed.ncbi.nlm.nih.gov)

Variable	Group A (n=600)	Group B (n=600)	p-value
Door-to-Balloon Time (minutes)	120 ± 30	90 ± 20	<0.001
Total Ischemic Time (hours)	6.5 ± 1.2	4.0 ± 0.8	<0.001
TIMI Flow Grade III Post-PCI (%)	75.0%	90.0%	0.005

Group B achieved shorter door-to-balloon and total ischemic times, along with higher rates of optimal post-PCI perfusion, as indicated by TIMI Flow Grade III.

Discussion

The findings of this multi-center study underscore the significant benefits of implementing standardized clinical pathways and early invasive strategies in the management of AMI in Pakistan. Patients in Group B, who received care through a structured clinical pathway incorporating early PCI, exhibited superior outcomes compared to those receiving standard care.

The marked improvement in LVEF among Group B patients aligns with previous research demonstrating the efficacy of early invasive strategies in enhancing cardiac function post-AMI .

The reduction in in-hospital mortality and rehospitalization rates further corroborates the advantages of timely and standardized interventions.11-15

The shorter door-to-balloon and total ischemic times observed in Group B highlight the importance of streamlined processes and rapid decision-making in acute cardiac care. These time metrics are critical determinants of myocardial salvage and overall patient prognosis.16-17

The higher achievement of TIMI Flow Grade III in Group B indicates more effective reperfusion, which is associated with improved clinical outcomes. This finding emphasizes the role of procedural efficiency and expertise in achieving optimal results.18-20

The study's multi-center design enhances the generalizability of the findings across diverse healthcare settings in Pakistan. However, the study also highlights the need for broader implementation of standardized clinical pathways and early invasive strategies to improve AMI outcomes nationwide.

Despite the positive outcomes, challenges remain in ensuring timely access to PCI facilities, especially in rural and underserved areas. Efforts to expand infrastructure, train healthcare personnel, and raise public awareness about AMI symptoms and the importance of early presentation are essential.

Future research should focus on long-term outcomes beyond six months, cost-effectiveness analyses of standardized pathways, and strategies to overcome barriers to implementation in various healthcare contexts.

Conclusion

This study demonstrates that the implementation of standardized clinical pathways and early invasive strategies significantly improves outcomes in AMI patients in Pakistan. The findings address critical gaps in the timely and effective management of AMI, providing a framework for enhancing cardiac care in resource-limited settings. Future initiatives should focus on scaling these interventions to achieve nationwide improvements in cardiovascular health.

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